

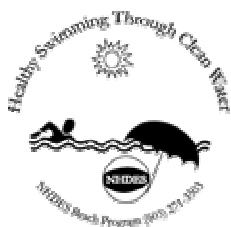
# **New Castle Town Beach, New Castle**

## **BEACH WATER QUALITY REPORT SUMMER 2006**



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## **BACKGROUND**

The New Hampshire Department of Environmental Services (DES) has operated a Public Beach Inspection Program, or Beach Program, for over 20 years. An established coastal beach monitoring program began in 1989 and the program continues to provide monitoring on a weekly basis. DES recognizes the health threat at public beaches. As a result, increased beach monitoring and bacteria source tracking have been implemented to further protect public health.

Coastal beaches are monitored for the presence of the fecal bacteria *Enterococci*. These fecal bacteria are present in the intestines of warm-blooded animals including humans. Fecal bacteria, when present in high concentrations and ingested, can commonly cause gastrointestinal illnesses such as nausea, vomiting and diarrhea. They are also known as indicator organisms, meaning their presence in water may indicate the presence of other potentially pathogenic organisms.

In October of 2000, the United States Environmental Protection Agency (EPA) signed into law the Beaches Environmental Assessment and Coastal Health (BEACH) Act. The BEACH Act is an amendment to the Clean Water Act, which authorizes the EPA to award grants to eligible states. The purpose of the BEACH Act is to reduce the risk of disease to users of the nation's recreational waters. BEACH Act grants provide support for development and implementation of monitoring and notification programs that help protect the public from exposure to pathogenic microorganisms in coastal recreation waters.

DES received grant funding in 2002 to develop and implement a beach monitoring and notification program consistent with EPA's performance criteria requirements published in the *National Beach Guidance and Required Performance Criteria for Grants* document ([www.epa.gov/waterscience/beaches/grants](http://www.epa.gov/waterscience/beaches/grants)). DES has successfully met all requirements and continues to expand the monitoring and notification program. In 2002, only nine coastal beaches were monitored, while in 2003 and 2004, 15 and 16 beaches respectively, were monitored on a routine basis. Fifteen beaches were sampled again in 2005 and 2006. In 2004, volunteers sampled Star Island beach, but circumstances did not allow for this cooperative effort in 2005 and 2006.

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## Beach Description

New Castle Town Beach is owned and maintained by the Town of New Castle. The beach is comprised of soft sand with a total length of 840 feet. The beach is frequently used by town residents and vacationers for various recreational activities. There are two beach access points from the New Castle Commons and Ocean Street (Figure 1). The beach is only one attraction at the Commons; a large picnic and playground area make this beach very popular for families and group outings. Lifeguards are not present and sanitary facilities are available.



**Figure 1. New Castle Town Beach Access Points and Restroom Facilities**

Small numbers of gulls and cormorants are frequently observed and documented in the area. Restrictions are in place to keep dogs off the beach.

Four sample stations have been created at New Castle Town Beach. The stations are based on the Tiered Monitoring Plan and are described in Table 1. All stations are accessed via the New Castle Common off Route 1B. Figure 2 depicts the station locations.

**Table 1. Station Descriptions**

Description	Latitude	Longitude
<b>Left sample station:</b> located in front of a wood clapboard house near the north end of the beach.	43° 4' 3.9517"	-70° 42' 47.7898"
<b>Center sample station:</b> located between a gulley and a brown house with a chimney and sun room.	43° 4' 1.2368"	-70° 42' 48.2041"
<b>Right sample station:</b> located in front of the first pine tree on the left as you enter the beach area from the park.	43° 3' 59.4561"	-70° 42' 47.9113"
<b>Pipe sample:</b> located just across a berm from New Castle Town Beach. It can be accessed from New Castle Town Beach or from Ocean Drive off of Route 1B.	43° 4' 7.838"	-70° 42' 46.3721"



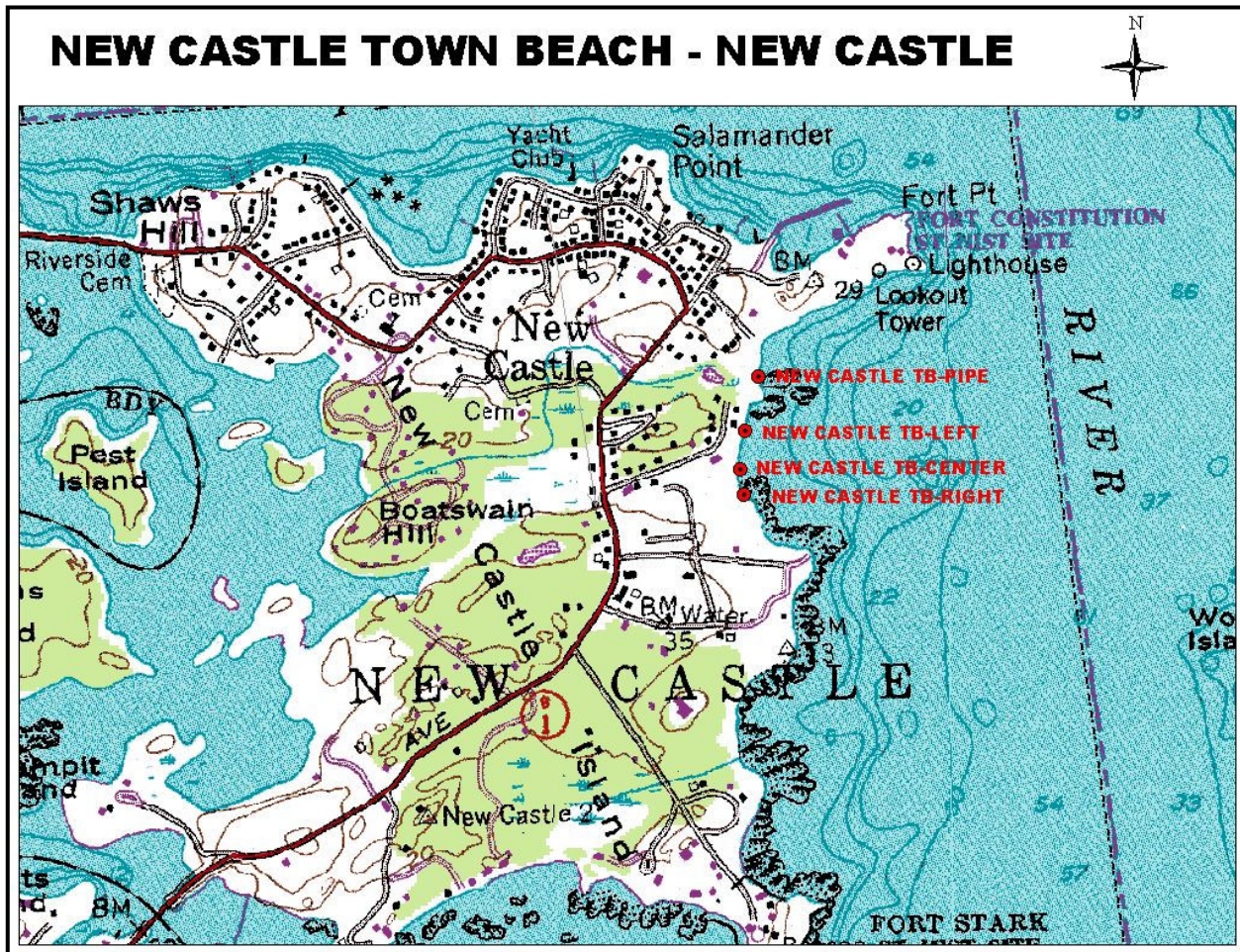


Figure 2. Map of New Castle Town Beach Sample Stations

### Tier Status and Sampling Frequency

The Beach Program developed a risk-based beach evaluation process and tiered monitoring approach and implemented this approach during the 2003 beach season. Beach evaluations are conducted annually to determine potential health threats to the public. Evaluations are based on several criteria in three main categories: beach history, microbial pathogen sources, and beach use. The evaluations for the 2006 season included a new criterion to assess beaches. Beaches are now assessed as impaired for bacteria. Impairments are based on the most recent version of the Consolidated Assessment and Listing Methodology (CALM) submitted to EPA by DES every two years. The CALM assesses beach units as impaired based on historical exceedances of both the single sample and geometric mean bacteria standards.

Based on these criteria, beaches were assigned a Tier I-Impaired, Tier I or Tier II status in 2006. Tier I-Impaired beaches are high priority and have an increased potential to affect public health, Tier I are medium priority, while Tier II are low priority beaches that have less potential to affect

public health. Beach sample frequency is based on the Tier statuses; Tier I-Impaired beaches were sampled twice per week, Tier I beaches were sampled once per week, and Tier II beaches were sampled once every other week in 2006.

New Castle Town Beach is a Tier I-Impaired beach. It is categorized as a Tier I-Impaired beach due to historical exceedances of the state standard for Enterococci, the issuance of a beach advisory in 2003, and the pipe discharge. The beach rank has changed since the ranking system was implemented in 2002. The identified risks warrant beach sampling twice per week.

## **Water Quality**

Beaches are monitored to ensure compliance with State Water Quality Standards. Marine waters are analyzed for the presence of the fecal bacteria Enterococci. Enterococci are known as indicator organisms, meaning their presence may indicate the presence of other pathogenic organisms. The state standard for Enterococci at public beaches is 104 counts/100 mL in one sample, or a geometric mean of 35 counts/100 mL in three samples collected over 60 days. Standard exceedances require the issuance and posting of a beach advisory. Beach advisories remain in effect until subsequent beach sampling indicates safe water quality conditions.

The number of samples collected at each beach is a function of beach length. Beaches less than 100 feet in length are sampled at left and right locations 1/3 of the distance from either end of the beach. Beaches greater than 100 feet in length are bracketed into thirds and sampled at left, center and right locations. Routine sample collection may be enhanced by sampling known or suspected pollution sources to the beach area. Storm event sampling may be conducted at beaches where wet-weather events are expected to affect beach water quality.

Since New Castle Town Beach is over 100 feet in length, three sample stations were established at the right, center and left (Table 1 and Figure 2). In addition, a pipe is present on the left side of the beach and historical data indicates it as a bacterial source to the beach. The pipe was sampled during low tide and when flowing.

The 2006 season's weather can best be unpredictable. The sampling season began on May 30. During the month of May, New Hampshire experienced flood conditions typical of a 100-year flood, while the months of June and July were wetter and warmer than normal, and August was unseasonably cool and dry. May experienced over 17 inches of rain setting a record high for the month and over eight inches of rain fell during June (as recorded at Pease International Tradeport, Portsmouth, N.H.). Precipitation was recorded on 34 days of the 95 day sampling season. Twenty-two beach days were directly affected by precipitation (assuming beach hours of 9:00 a.m. to 5:00 p.m.). There were a total of 29 routine inspections performed and 101 samples collected at New Castle Town Beach in 2006.

Table 2 and Figure 3 depict the Enterococci data from each sampling event in 2006. Overall, the summer 2006 Enterococci levels were moderate and within the state's standards for public beaches. Enterococci levels approached the state standard on July 25 and 26 and the left station exceeded the standard on July 27. Over 0.5" of rainfall was recorded prior to that period (Figure 5) suggesting rainfall negatively impacts this area's beach water quality. A beach advisory was

not issued due to a resample that showed acceptable Enterococci levels within a 24 hour period. Pipe Enterococci levels were elevated from mid to late July suggesting that the pipe discharge may negatively impact beach water quality, particularly at the left station. The right station Enterococci levels spiked above the standard on August 28 but were within the state standards by August 30. Once again over 0.5" of rainfall was recorded prior to August 28.



**Table 2. New Castle Town Beach Enterococci Data 2006**

<b>Sample Date</b>	<b>Station</b>	<b>Enterococci Results (counts per 100 mL)</b>
5/22/2006	Left	5
	Center	10
	Right	10
6/1/2006	Left	10
	Center	10
	Right	10
6/5/2006	Left	10
	Center	10
	Right	10
6/8/2006	Left	50
	Center	90
	Right	90
6/14/2006	Left	10
	Center	10
	Right	40
6/15/2006	Left	5
	Center	10
	Right	50
6/20/2006	Left	10
	Center	10
	Right	20
6/22/2006	Left	10
	Center	50
	Right	5
6/26/2006	Left	30
	Center	10
	Right	90
6/29/2006	Left	10
	Center	10
	Right	80
7/6/2006	Left	10
	Center	10
	Right	5
7/10/2006	Left	10
	Center	10
	Right	5
7/12/2006	Left	10
	Center	5
	Right	10
7/17/2006	Left	20
	Center	20
	Right	10

7/18/2006	Left	10
	Center	40
	Right	10
7/25/2006	Left	70
	Center	50
	Right	70
7/26/2006	Left	90
	Center	30
	Right	5
7/27/2006	Left	290
	Center	10
	Right	5
7/28/2006	Left	10
	Center	10
	Right	30
8/1/2006	Left	10
	Center	10
	Right	5
8/2/2006	Left	20
	Center	10
	Right	10
8/7/2006	Left	10
	Center	10
	Right	10
8/9/2006	Left	100
	Center	10
	Right	100
8/14/2006	Left	10
	Center	10
	Right	5
8/17/2006	Left	10
	Center	10
	Right	5
8/22/2006	Left	40
	Center	10
	Right	40
8/23/2006	Left	10
	Center	10
	Right	20
8/28/2006	Left	10
	Center	10
	Right	170
8/30/2006	Left	10
	Center	10
	Right	10

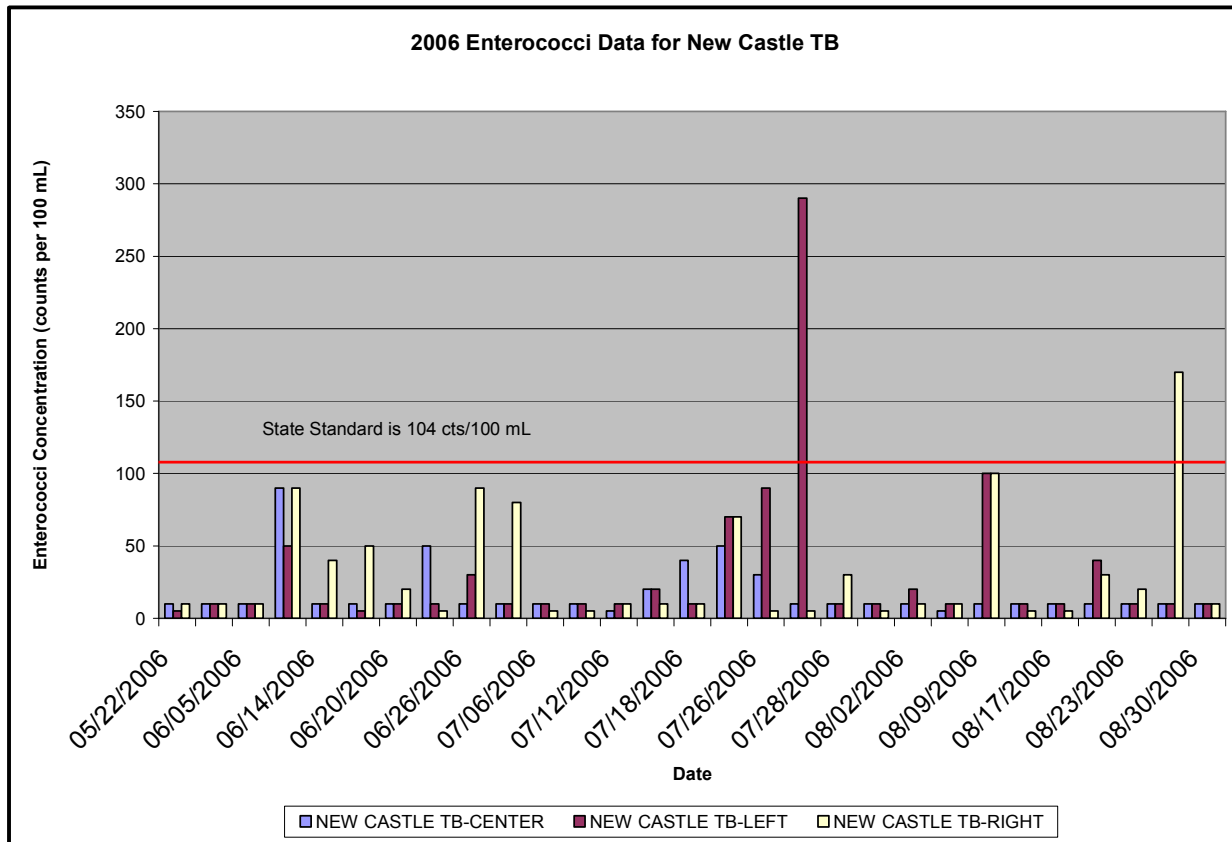
Table 3 and Figure 4 include 2006 Enterococci data collected from the pipe. The pipe discharges beyond the left end of the beach. A series of wetland systems drain Little Harbor and traverse the island from West to East, culminating in a small pond that drains through the pipe. Samples are collected only when there is sufficient flow to collect a clean sample. Otherwise, flow was too low for sample collection or the pipe was closed.

Pipe Enterococci levels were elevated in July and late August. Rainfall likely increases pond flushing where bacteria may concentrate during dry weather. The pipe discharge may be transported through ocean currents to the beach area where the water negatively impacts the beach water quality.

**Table 3. New Castle Town Beach Pipe Enterococci Data 2006**

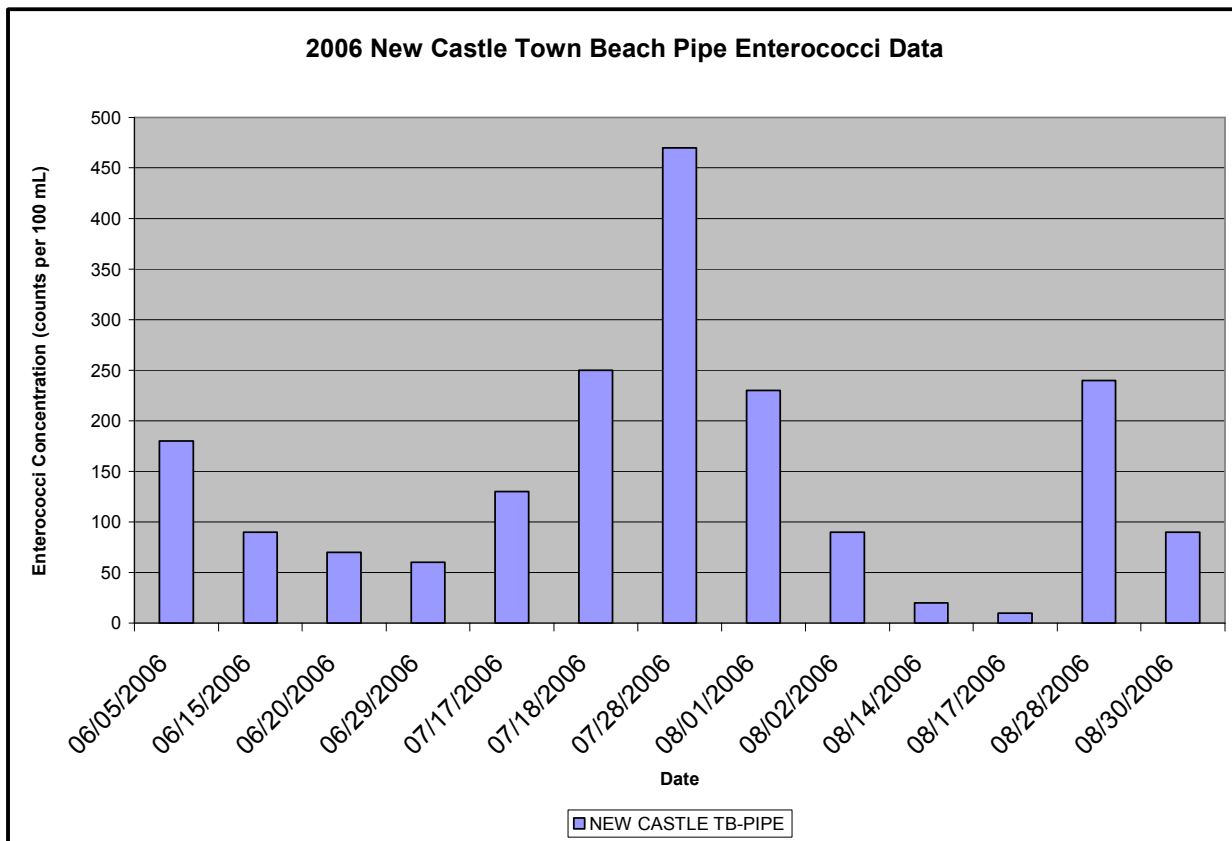
<b>Sample Date</b>	<b>Enterococci Results (counts per 100 mL)</b>
6/5/2006	80
6/15/2006	90
6/20/2006	70
6/29/2006	60
7/17/2006	130
7/18/2006	250
7/28/2006	470
8/1/2002	230
8/2/2006	90
8/14/2006	20
8/17/2006	10
8/28/2006	240
8/30/2006	90

Figure 3 depicts New Castle Town Beach Enterococci data relative to the state standard for coastal beaches.



**Figure 3. New Castle Town Beach Enterococci Data 2006**

Figure 4 depicts the 2006 Pipe Enterococci data.



**Figure 4. New Castle Pipe Enterococci Data 2006**



Figure 5 depicts precipitation during the months of June, July and August (as recorded at Pease International Tradeport, Portsmouth, N.H.) and compares them to the average beach Enterococci levels measured at New Castle Town Beach. Enterococci levels generally appear to spike after rainfall events greater than 0.5". Although the average bacteria levels never exceeded the state standard, these events should be monitored further in the future.

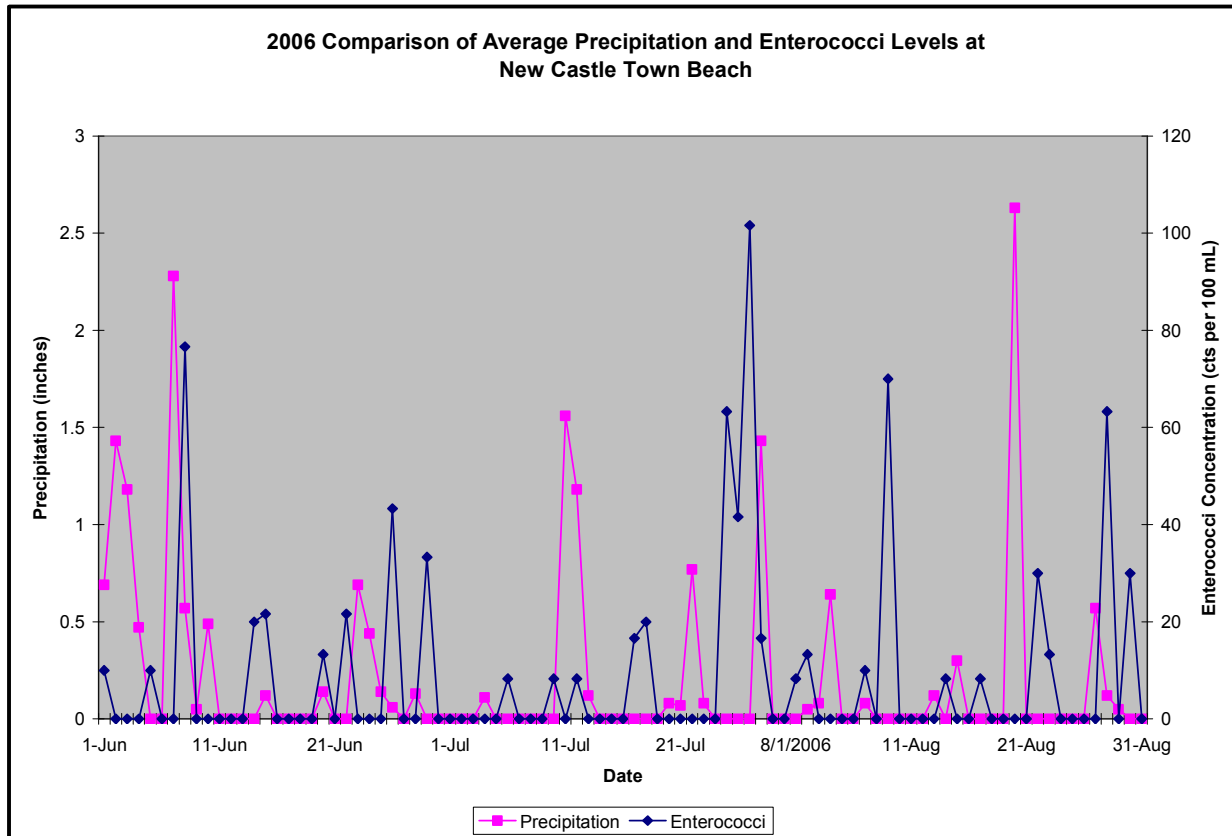


Figure 5. Comparison of Precipitation and Average Enterococci Levels at New Castle Town Beach

### Areas of Concern

Bull Toad Pond located at New Castle Common has recently undergone restoration activities to remove invasive plant species. Several groups are involved in the project, including New Hampshire Coastal Program, the Town of New Castle and New Castle Conservation Commission. The pond is located west of the New Castle Town Beach area and drains between the right and center station of the beach during spring. This drainage likely contains elevated bacteria levels from the surrounding marsh area.

The Pipe located to the left of New Castle Town Beach often discharges bacteria laden waters to the ocean. It is possible that ocean currents transport the bacteria to the beach area contributing

to elevated beach Enterococci levels. The Beach Program contracted with the University of New Hampshire's Jackson Estuarine Laboratory in 2006 to study the pipe discharge. The study employed a technique known as microbial source tracking to identify the pipe and beach bacteria sources. The study results documented the bacteria sources to be human, waterfowl, wildlife, or domestic animals. Results from this study will be available in the spring of 2007. The report will be forwarded to Town officials.

### Thoughts for the Future

- A study to quantify the bacteria levels in the sand at New Castle Town Beach may be warranted. Studies in other areas of the country have shown concentrated populations of bacteria in the onshore sand near the water line. Initiating a similar project at the beach could prove if bacteria proliferate in the sand and contribute to elevated beach bacteria levels. If the town is interested in pursuing such a scientific study, the Beach Program could fund the study for the 2008 sampling season. Please contact Alicia Carlson to discuss your options, (603) 271-0698 or [acarlson@des.state.nh.us](mailto:acarlson@des.state.nh.us).
- New Castle Town Beach should consider installing pet waste stations because many people use the beach in the off season to walk dogs. Fecal matter often contributes to nutrient and bacteria loading to many beaches. Pet waste stations will help to reduce the amount of fecal matter on the beach.
- Discharge from Bull Toad Pond impacts the beach area during the spring/early summer months. This discharge likely contains elevated bacteria levels from the marsh. We recommend restricting access to the discharge. Young children tend to play in these warmer waters creating a health risk. The area can be roped off with a warning sign that states the water may contain elevated bacteria levels.

## **Appendix A**

### **Special Topic 2006**

## Rapid Assessment Methodology for the Detection of Microbiological Indicators

To assess beach water quality, the Department of Environmental Services (DES) monitors fecal indicator bacteria levels at coastal beaches on a routine basis. Unfortunately, results from sample analysis can take anywhere from 24 to 48 hours. Because it takes at least 24 hours to receive results, beach managers and the public are not informed of water quality problems until after the public may have been exposed. This is an issue facing beach officials throughout the world, and is a priority of the US Environmental



Protection Agency (EPA). The EPA, universities and private entities are researching rapid assessment methods to enumerate bacteria and viruses. These methods will allow beach officials to post advisories on the same day water quality is impaired, thus, better protecting public health. There are three different rapid assessment method technologies available: Molecular surface recognition, nucleic acid detection and enzyme/substrate based methods. All rapid assessment methods will take less than two hours to obtain results.

Molecular surface recognition methods capture and/or label the target bacterium by binding to molecular structures on the exterior surface or in its genetic material. Analyses of coastal beach water samples currently employ culture-based methods for the detection of Enterococci bacteria, an indicator for fecal pollution in marine water. The quickest culture-based method takes up to 24 hours to provide results. Now, a new method is being developed to enumerate Enterococci. This new method uses Transcription-Mediated Amplification (TMA) with a fluorescently-labeled probe to amplify a specific region of Enterococci ribosomal RNA (rRNA).

The TMA rapid assessment method is currently being tested in Southern California. Method development is moving quickly and will likely come to execution within five years. Method cost is a significant reason the new technology is not currently employed. Once this procedure is widely and routinely accepted, the expenses should lower. This rapid assessment method is very beneficial as it will allow beach managers to take immediate action towards protecting the public from waterborne pathogen exposure on the same day water is sampled.

Another rapid assessment method being developed for fecal indicator detection is called Quantitative Polymerase Chain Reaction (QPCR). QPCR is a nucleic acid detection method that targets genetic material of bacteria, viruses or protozoan indicators. QPCR is used to test for both *E. coli* and Enterococci. Results can be obtained from this method on an average of two hours after sampling. This method has demonstrated 85-90 percent agreement with existing routine methods. QPCR can be used to detect other water quality indicators such as *Bacteroides*

*thetaitamicron* and human enterovirus. Studies indicate that ratios of *B. thetaitamicron* may provide useful information as to fecal contamination sources.

The final rapid assessment technology methods available are the enzyme/substrate based methods. These methods pair chromogenic or fluorogenic substrate methods already widely used with advanced optical or electrical detectors. These methods are directed at reducing the incubation periods of current membrane filtration methods. Some of these methods measure excitation and absorbance of the fluorescent metabolite of Enterococci using a fluorometer to speed the detection rate. A popular type of enzyme/substrate method is called the Dual-Wavelength Fluorimetry (DWF).

These rapid assessments methods are currently being tested for accuracy, sensitivity and efficiency. Research indicates that these new methods will be made available within the next five years. Once these technologies are made available and laboratories adopt the methods, beach management will have a new tool to better protect public health. With assistance from EPA Beach Grants, New Hampshire will be proactive in employing accepted methods.